



Hypercube Update



ASNE Technical Review

Asheville, NC

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Guy Seeley, Radex Inc.

Dan Moonan, Radex Inc.



Overview



- Hypercube Concept
- Process Flow
- Cluster computing
- Future



Hypercube Concept



- Need: A tool to provide realistic environmental impacts on aggregate-level simulations
 - High-fidelity simulation can not be used directly
 - Low compute burden essential
 - Bridge gap between hi-fi simulation and aggregate statistics



Hypercube Concept



$P_x = f$ (Sensor, Target, Background, Weather, Tactics, etc.)

P_d - Probability of detection

P_r - Probability of recognition

P_i - Probability of identification

Physical simulation during runtime not always feasible particularly when these parameters are highly variable (e.g., clouds and background)

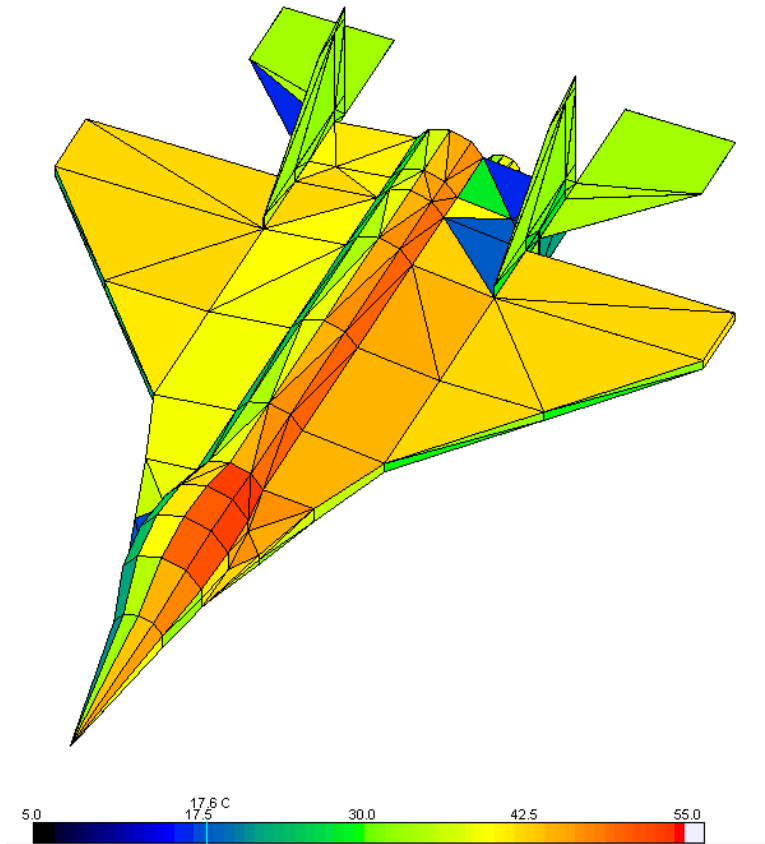
Concept: Generate probabilities prior to simulation runtime with many “virtual sorties.” Can use climatology or specific weather as input. Interpolate over resulting hypercube at runtime to get P_x .



TAWS-A

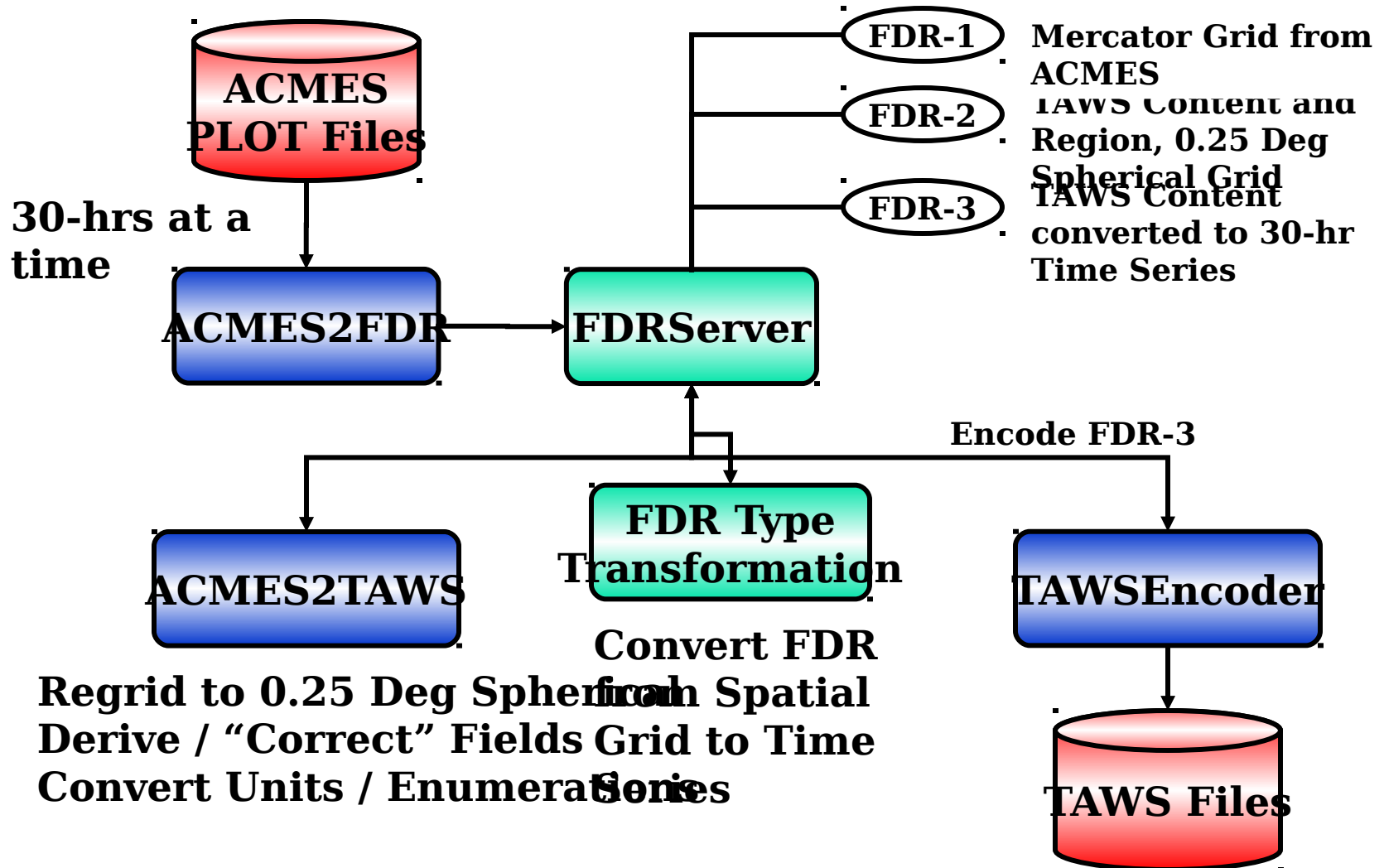


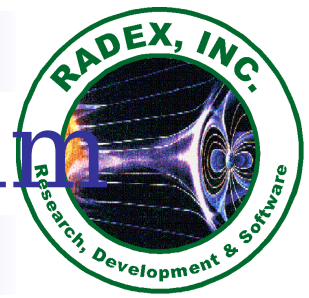
- Physical Model Core of the Operational TAWS Software
- Currently Using Infrared (IR) Model Only
- Model Uses
 - Sensor Info
 - Time of Day
 - Weather
 - Target and Background Info
- TV/NVG and Laser Future Candidates



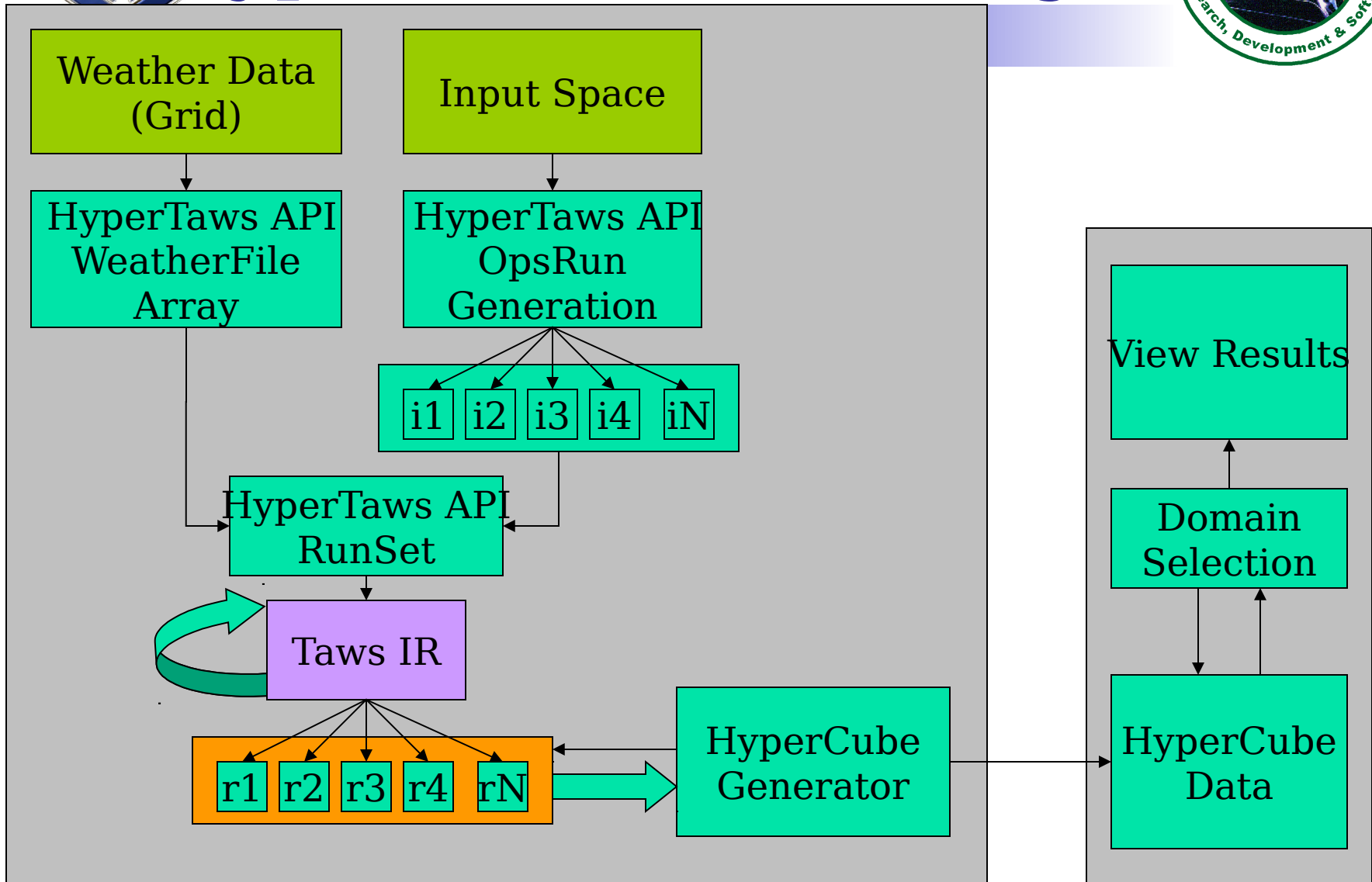


ESG TAWS Wx Processing





HyperTaws Flow Diagram





Many TAWS Runs



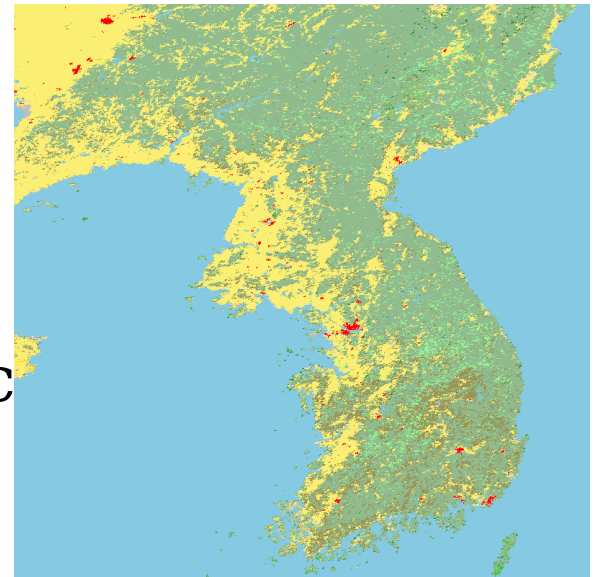
41 x 41 Grid = 1681 Weather Points/TAWS runs p

4 Months of data processed = 122 days
January 1998, 1999 June 1994, 1996

T-62 tank target

205,082 TAWS runs

If manual 6,152,460 mouse c





Cluster Computing



Simplified abstract indices

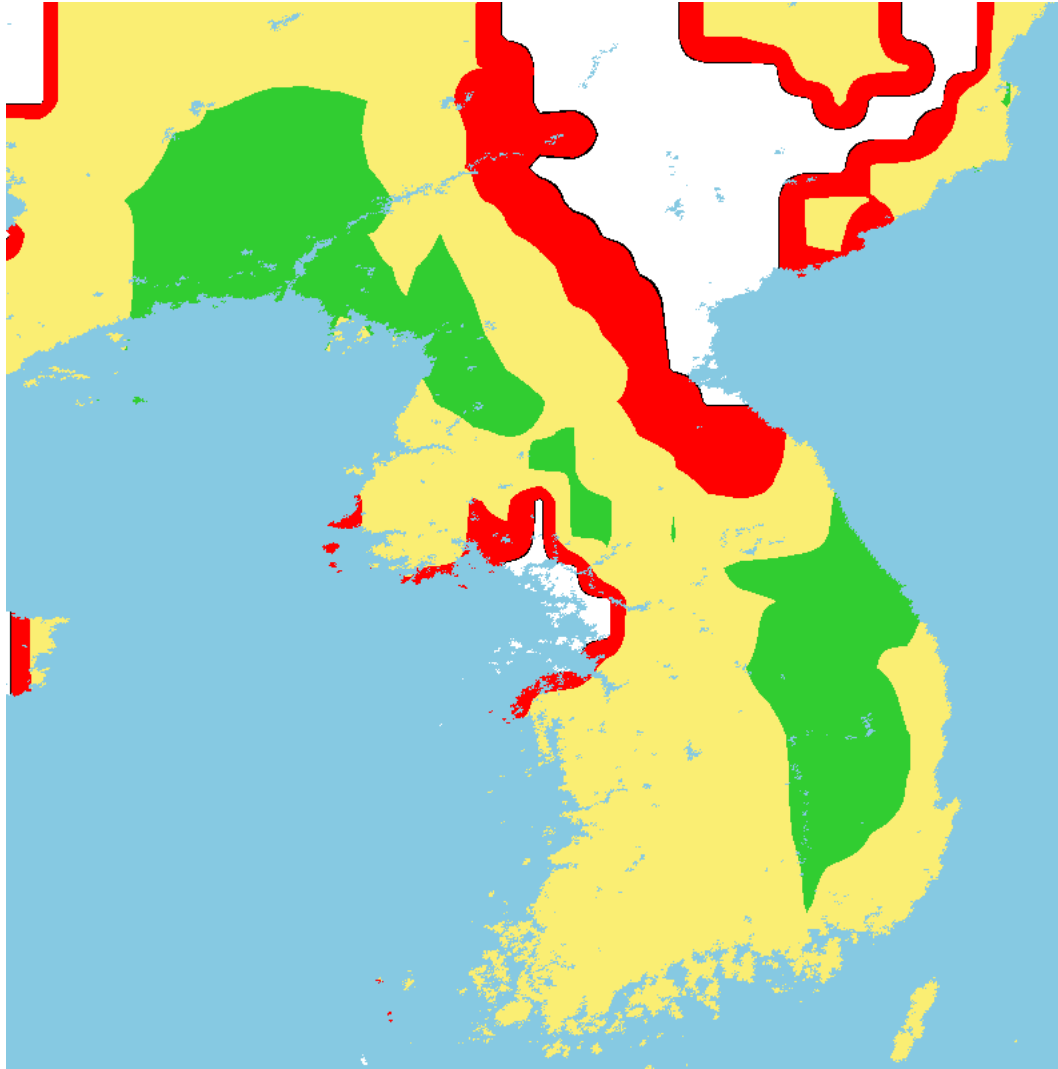
Efficient consolidation of results from cluster nodes

Verification of MPI vs. uniprocessor version

Overall efficiency improvement



Detection Range Map

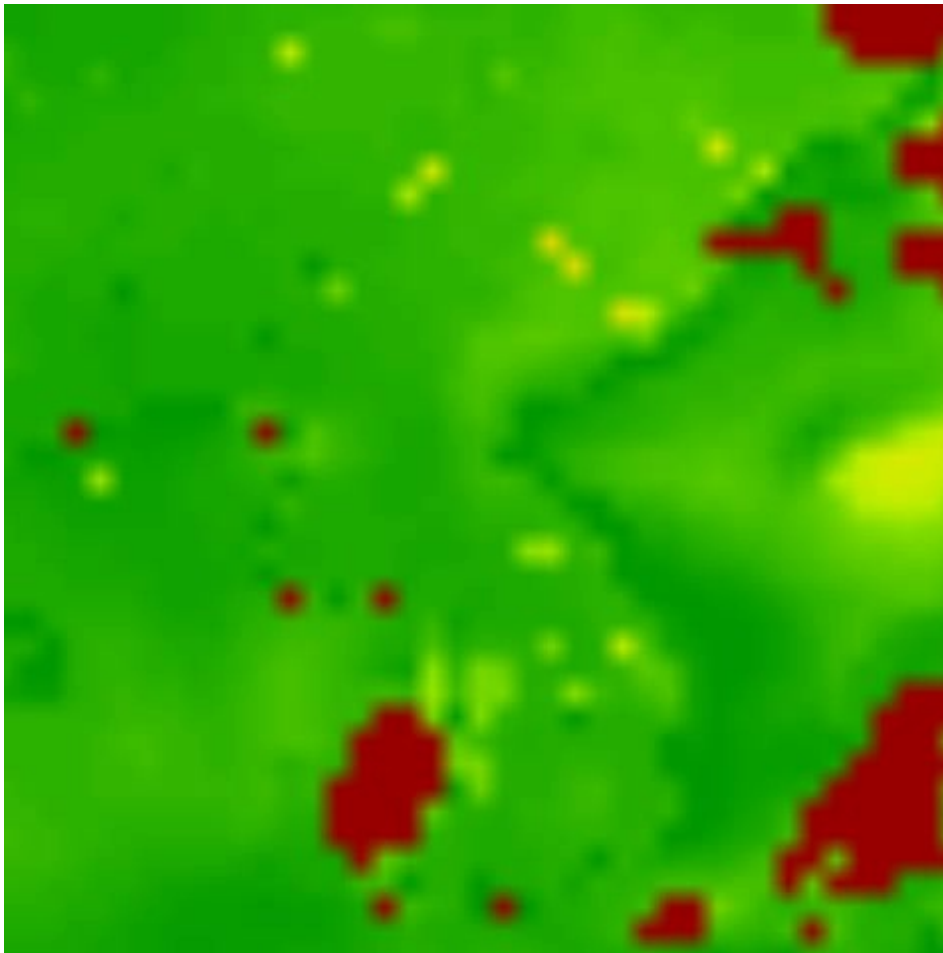


Date: Jan. 8, 1998
Time: 1400

Target: Tank
Altitude: 10000
View Angle: 0 deg.



Hypercube Animation



June 1994 Thresholded Detection Ranges - Tank ta

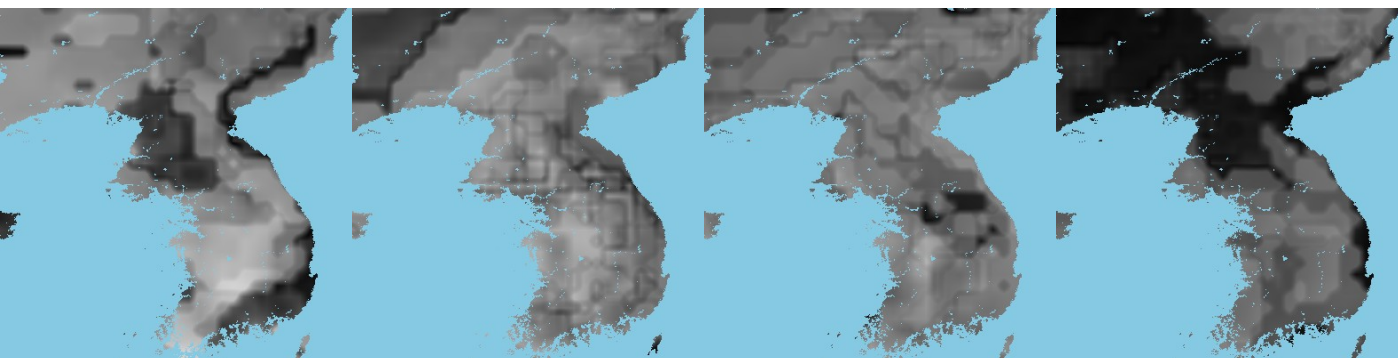


Detection Range Statistics

Averages



0 < Red < 3.14, 3.14 < Yellow < 6.86, 6.86 < Green
Standard Deviations: Bottom



Max: 4.15km

Max: 3.56km

Max: 3.52km

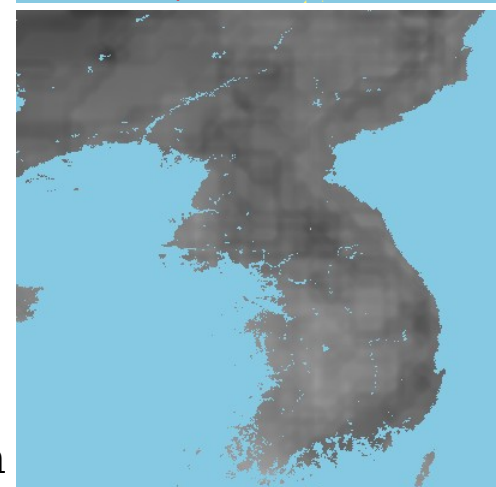
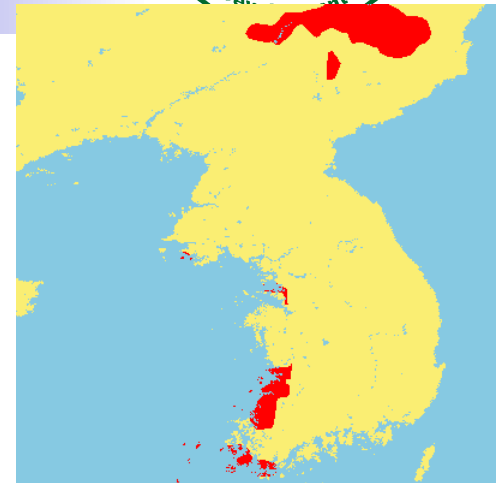
Max: 2.66km

2-7

8-14

15-21

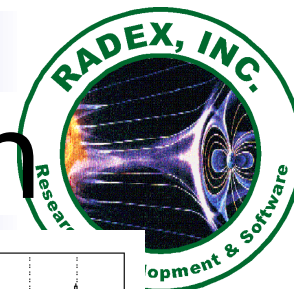
22-31



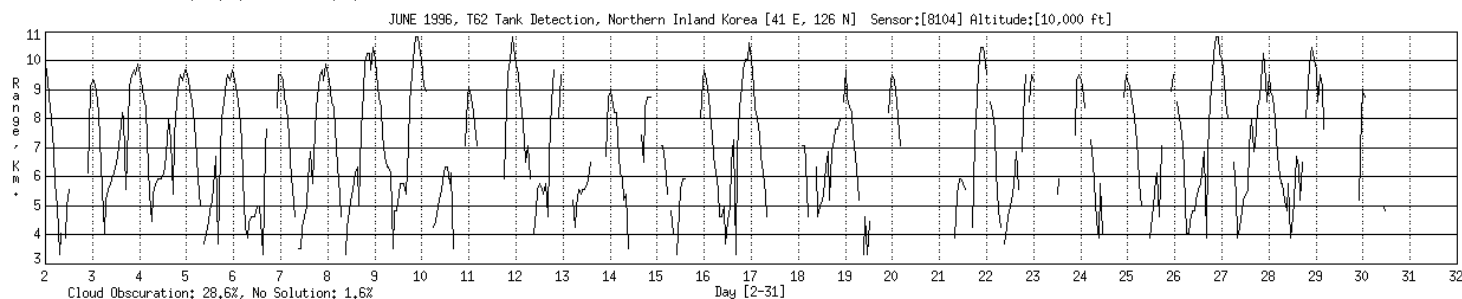
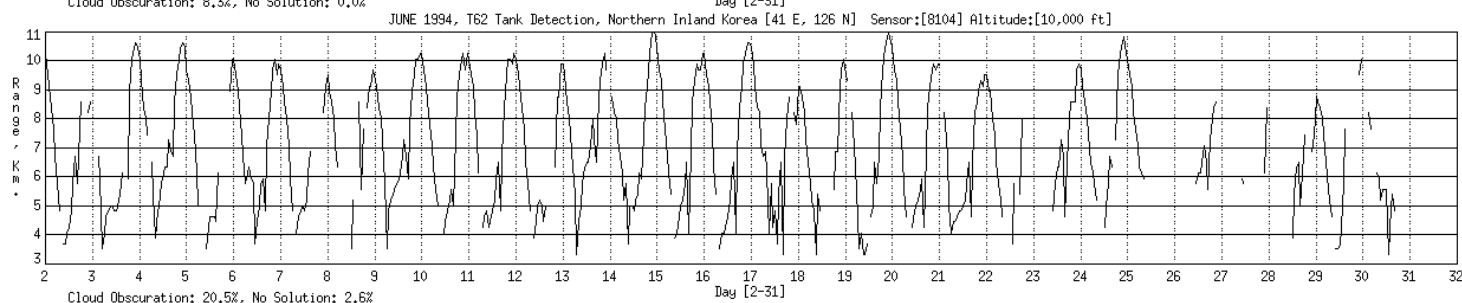
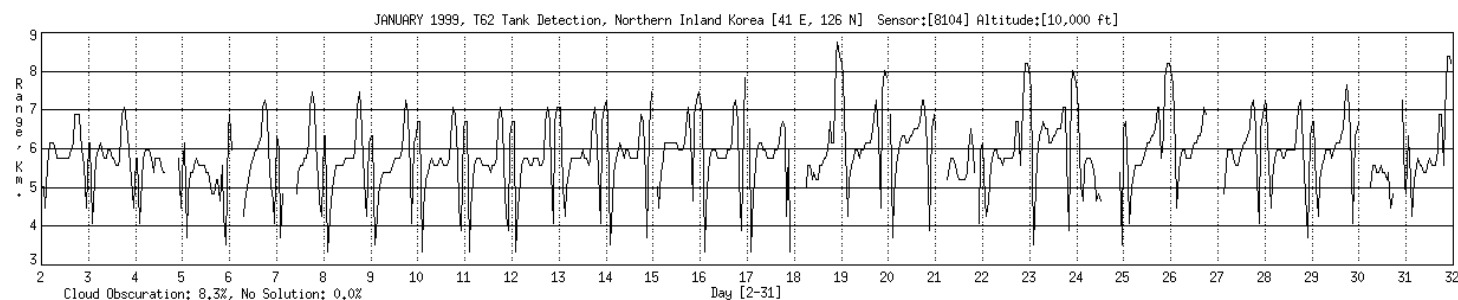
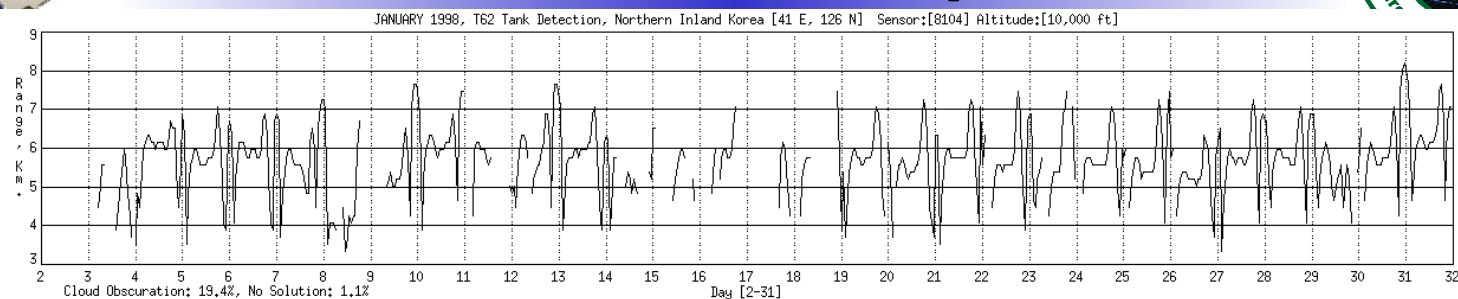
Max: 3.22km

> 50,000 TAWS runs - Beginnings of an output climatology

Sensor 8104, tank, view 0deg., 0000hours

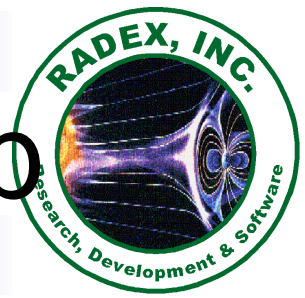


Seasonal Comparison

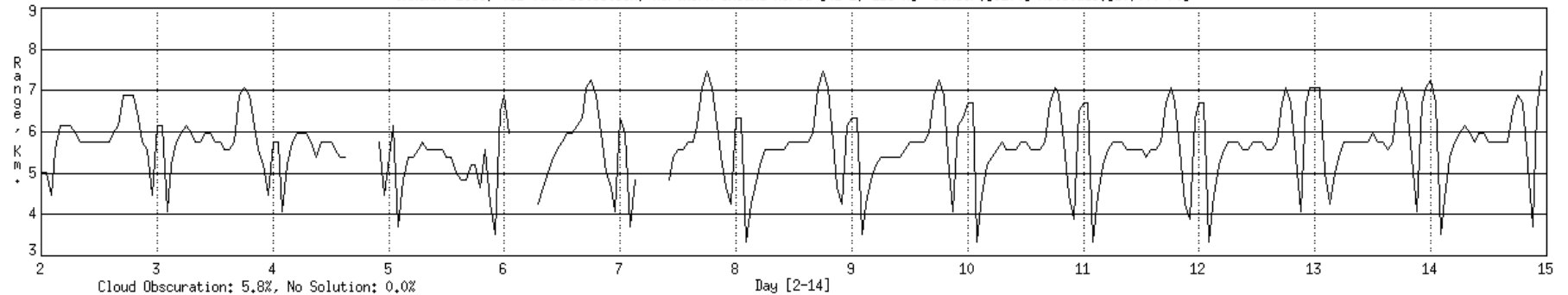




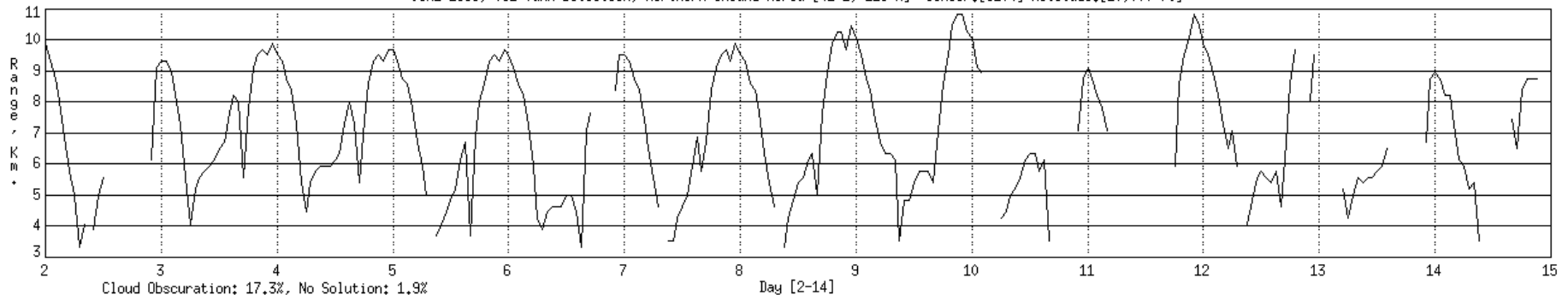
Diurnal Cycle Closeup



JANUARY 1999, T62 Tank Detection, Northern Inland Korea [41 E, 126 N] Sensor:[8104] Altitude:[10,000 ft]

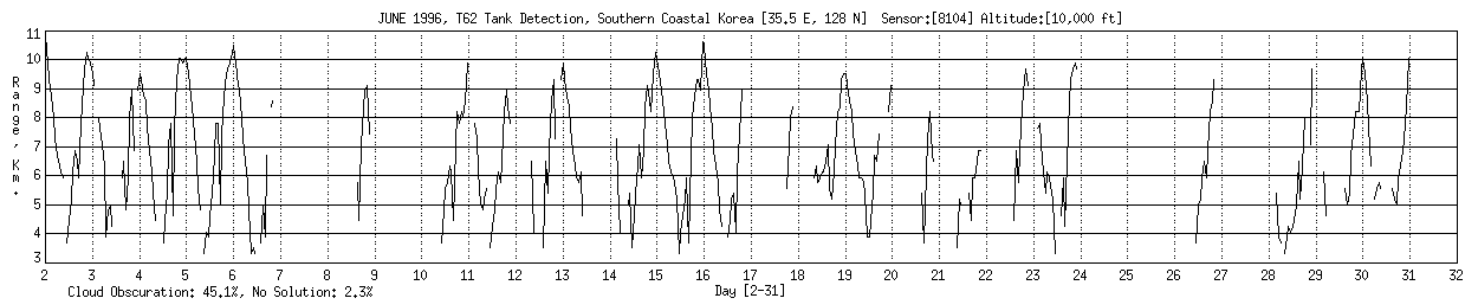
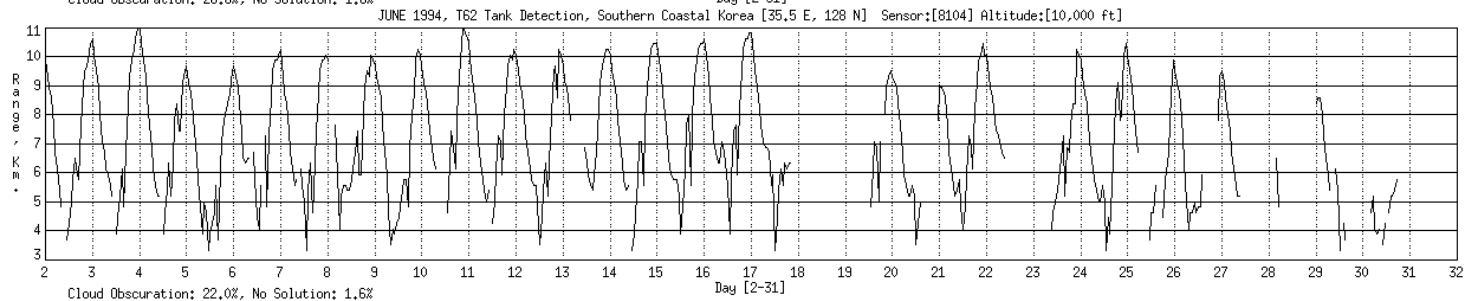
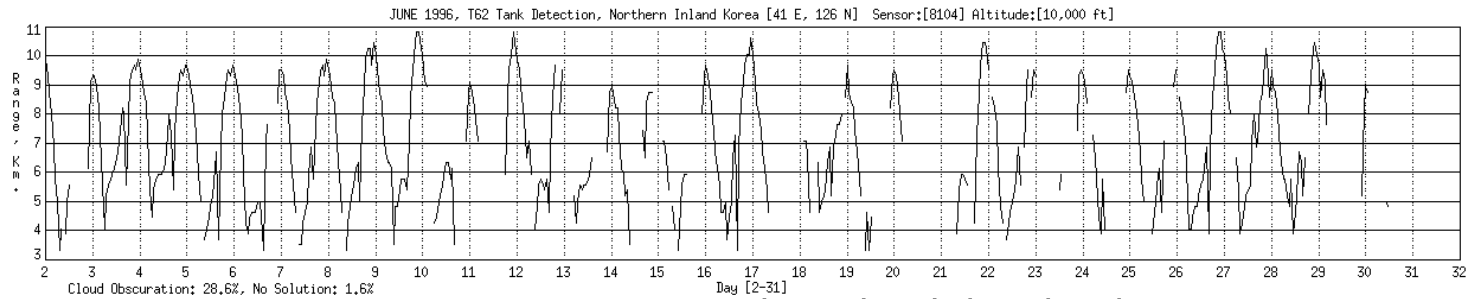
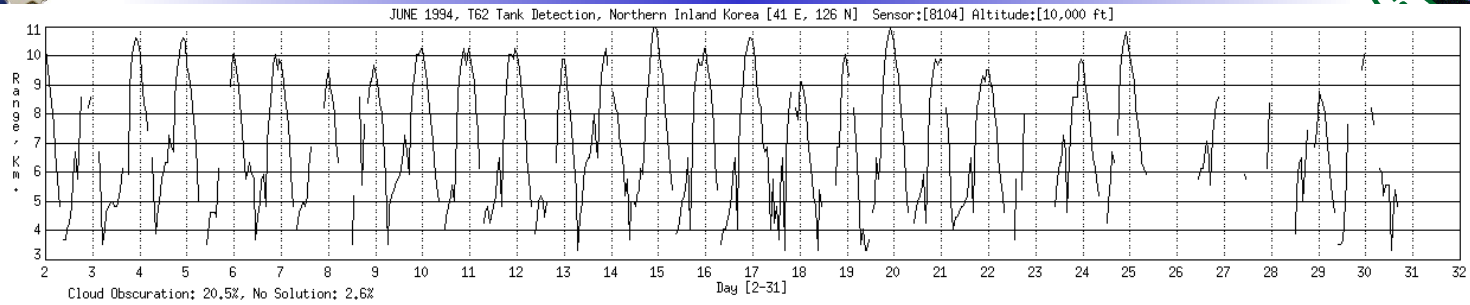
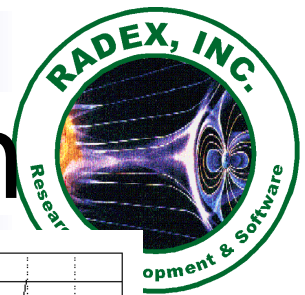


JUNE 1996, T62 Tank Detection, Northern Inland Korea [41 E, 126 N] Sensor:[8104] Altitude:[10,000 ft]



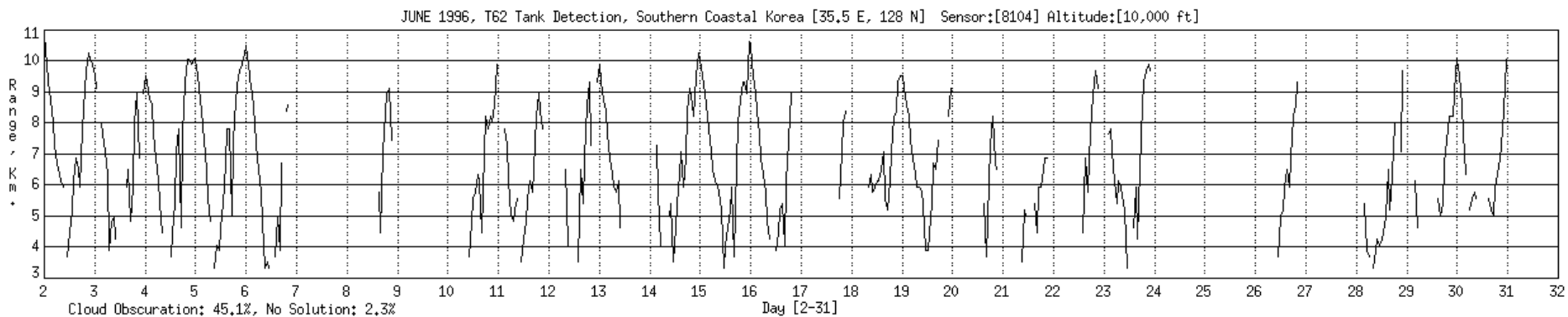
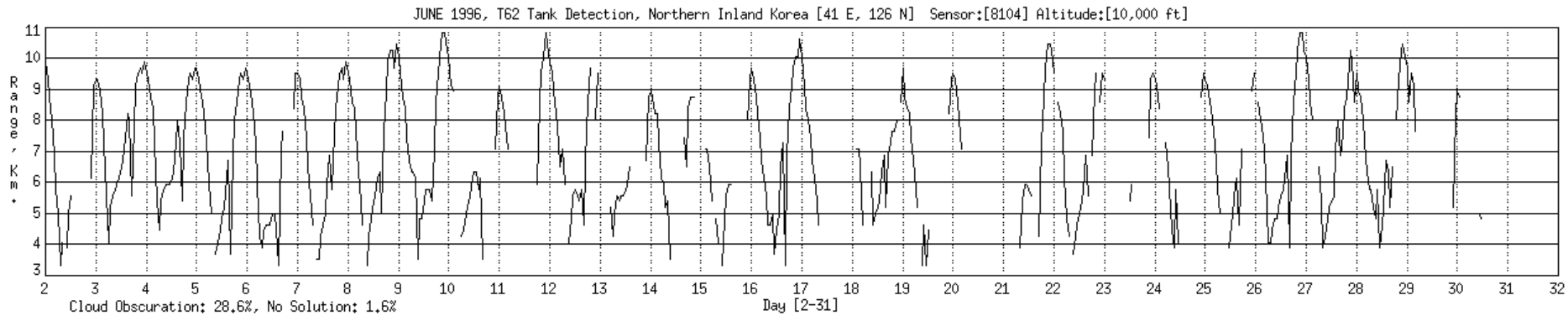


Regional Comparison





Regional Comparison June '96





Future Developments



- Development slowed in favor of WxFx
- Warfighter interest in TAWS hypercube products
- Cloud Free Line of Sight/ TAWS modeling
- Output to standard mapping tools